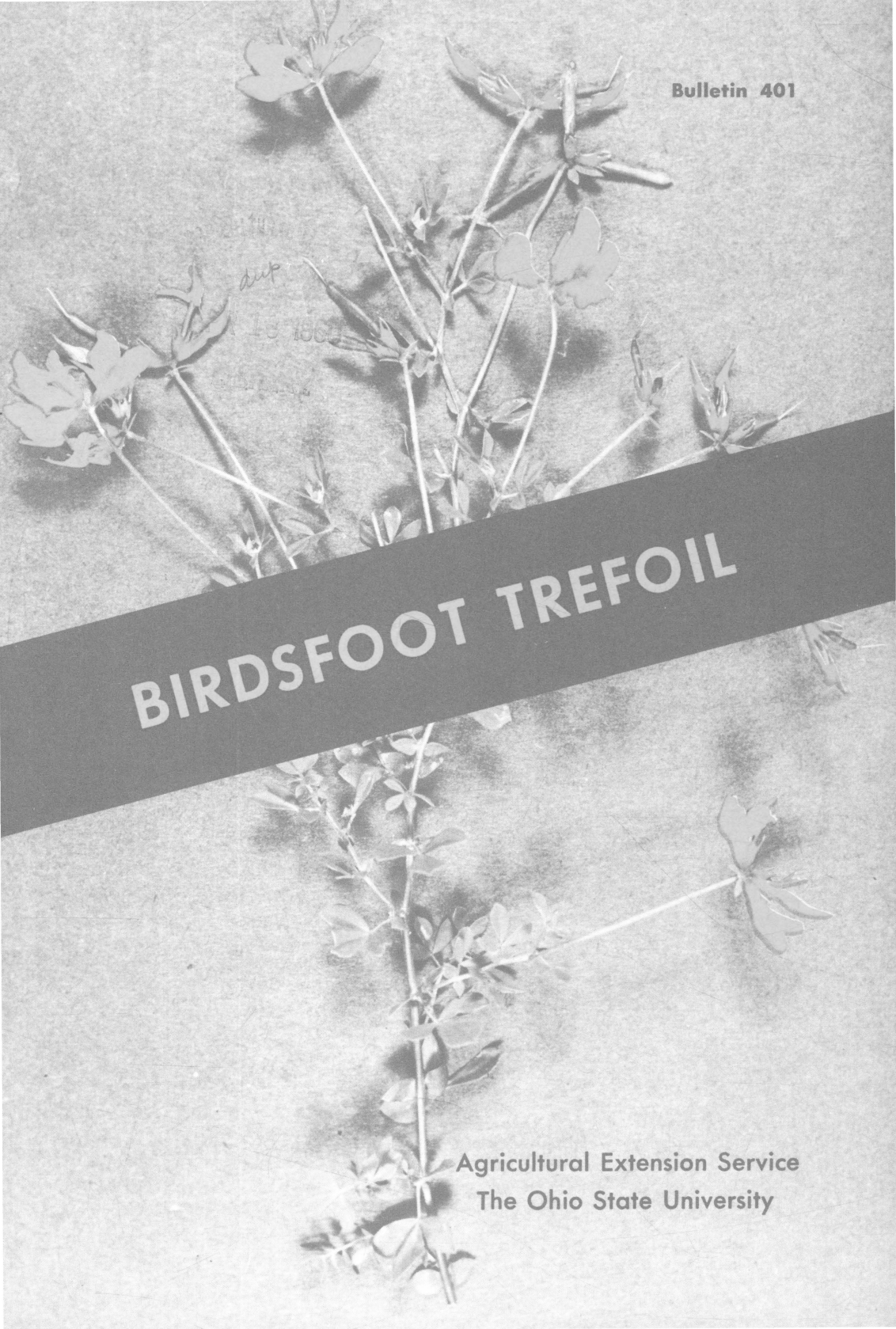

Bulletin 401

# BIRDSFOOT TREFOIL

Agricultural Extension Service
The Ohio State University

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ACKNOWLEDGMENT — *The author gratefully acknowledges the many helpful suggestions made by Doctors R. R. Davis, J. L. Parsons, and S. R. Anderson of the Department of Agronomy, The Ohio Agricultural Experiment Station.*



3/60—15M

Printed and distributed in furtherance of acts of May 8 and June 30, 1914. Agricultural Extension Service, W. B. Wood, director, Columbus 10, Ohio. The Ohio State University and U. S. Department of Agriculture cooperating.

# BIRDSFOOT TREFOIL

by

GEORGE R. GIST
Extension Agronomist

## Origin and History

Birdsfoot trefoil is not a new crop. British writers in the late 1700's referred to it as a useful forage plant. It has been used to a limited extent throughout much of Europe, particularly in France and north central Italy.

Birdsfoot trefoil is thought to have first been brought to this country as ship ballast, as feed accompanying livestock brought from Europe, or as an impurity in other forage seed.

Later, during the late 1800's seed introduced from Europe was planted at several experiment stations. The crop was difficult to establish, lacked seedling vigor, was lower in yield than alfalfa or clovers and was discarded.

Several years later, birdsfoot trefoil was found to have become naturalized and to have spread over a considerable area in parts of three counties in New York state and in sections of Washington and Oregon. In New York the naturalized birdsfoot was predominantly the broadleaf strain; however, in Washington and Oregon the narrowleaf strain was most prevalent.

During the early 1920's William Balus a farmer near West Union in Adams County, Ohio, purchased alfalfa seed from a farmer in Oregon. Balus planted this alfalfa, and in a few years, as the alfalfa plants died out, they were replaced by a new "weed." In 1930 Dr. S. J. Rigdon, a veterinarian, visited the Balus farm, at this time operated by Balus' son-in-law, John Sheeley. He was impressed with the growth and persistence of this new plant. Dr. Rigdon sent a specimen to Dr.

D. R. Dodd, Extension agronomist at The Ohio State University, who identified it as birdsfoot trefoil.

During the ensuing years, birdsfoot trefoil from this original field has spread over a large acreage. It has become established in gullied areas, in neglected or abandoned fields, along roadways, and even between the wheel tracks of infrequently traveled roads. Vigorous stands can now be found at distances of 2 miles or more from the original planting.

Farmers in the area recognize birdsfoot trefoil as a valuable plant. They have noted that it persists under grazing and that it grows on soils which will not produce a satisfactory growth of alfalfa or clover. When fields in which birdsfoot trefoil is growing are plowed for corn, a good crop is produced, and following the corn crop the birdsfoot trefoil volunteers into the field. This is largely the narrowleaf trefoil although some broadleaf plants also are present.

Dr. S. J. Rigdon inspects the original Adams County birdsfoot trefoil planting. (Summer, 1959)

The early tests conducted by research workers were on soils well adapted to alfalfa and red clover and the test plots were harvested as hay. Under these conditions birdsfoot trefoil was found to be less productive than alfalfa or clover.

Because of its persistence and growth in parts of New York State, Adams County, Ohio, and elsewhere on soils not well suited to alfalfa, birdsfoot trefoil again came to the attention of research agronomists. During the early 1940's new research was started. In the eastern and north central states this more recent research has been most promising. Birdsfoot trefoil is now recommended for use as a pasture legume in all of the midwestern and northeastern states.

## Species and Varieties

There are five species of birdsfoot trefoil. Only the broadleaf, *Lotus corniculatus*, is recommended for use in Ohio. Other species include:

1) Narrowleaf trefoil, *Lotus tenuis*, a perennial which is less drouth and heat tolerant and lower in yield than the broadleaf species.

2) Big trefoil, *Lotus uliginosus*, a perennial which lacks winter hardiness.

3-4) Two annual species *Lotus angustissimus* and *Lotus hispidus*, which are not used as forage plants in the United States.

## Varieties of Broadleaf Birdsfoot Trefoil

Within the broadleaf species there are two sub-groups: (1) the upright (hay) type and (2) the low-growing (pasture) type. The many intermediate forms make it difficult to clearly distinguish between individual plants of the two types in the field. Uncertified birdsfoot trefoil seed frequently contains seed of both the erect and low-growing types. Imported seed, although largely of the upright type, usually contains some seed of the lower growing birdsfoot trefoil.

*Upright types* of birdsfoot trefoil should be used where the field will be harvested as hay or silage or where a well-managed system of rotation grazing is to be followed. The upright types have more seedling vigor, are more easily established, and make a more rapid regrowth after a cutting or grazing than do the low-growing types. The upright types will not withstand continuous close grazing and are seriously damaged by clipping or grazing during the six week period from mid-September to the last of October.

*VIKING* is the upright variety recommended for use in Ohio. In Ohio yield tests Viking has consistently been the highest yielding variety.

Although not a variety, *IMPORTED* birdsfoot trefoil is largely of the upright type. Yields of Imported birdsfoot trefoil are generally somewhat lower than yields of Viking.

Other upright varieties, including *GRANGER*, *MANSFIELD* and *CASCADE*, have been included in yield tests and have been lower in yield than Viking.

*Low-growing types* of birdsfoot trefoil should be used where the field will be used for permanent pasture or where a regular system of rotation grazing will not be followed. The low-growing birdsfoot trefoil, although slightly lower in hay yield, will withstand heavy grazing much better than will the upright types.

*EMPIRE* is the only variety of low-growing birdsfoot trefoil currently available, and is the recommended variety.

## Importance and Use

### Pasture

Farmers in the eastern and midwestern states have wished for many years for a pasture legume with the long life and persistence of white clover and the drouth tolerance of alfalfa. Such a legume would be ideal for use in the many thousands of acres of permanent and semi-permanent pastures.

Of the legumes known today, birdsfoot trefoil most nearly meets these requirements. Its growth habits closely parallel those of alfalfa. Although it does not root as deeply as alfalfa, the long taproot of birdsfoot trefoil enables it to make considerable growth during the dry midsummer months.

Birdsfoot trefoil is a long-lived perennial which persists under all except the most abusive grazing management. With rotational grazing and adequate fertilization many stands have remained highly productive for periods of 20 years or longer. Stands should, in fact, remain almost indefinitely unless damaged by diseases or improper grazing. Birdsfoot trefoil stands have been almost completely killed by continuous close grazing by sheep over a three-year period.

The chart on pages 8 and 9 shows the growth patterns and carrying capacities of several types of pasture. Although birdsfoot trefoil pastures are somewhat less productive than alfalfa-grass mixtures the long life of birdsfoot trefoil makes it a particularly valuable pasture legume.

Birdsfoot trefoil pastures are more productive than bluegrass pastures which receive annual applications of nitrogen fertilizers. For permanent or semi-permanent pastures the low-growing Empire variety of birdsfoot trefoil is recommended for use in Ohio.

Hay

Where alfalfa grows well it is the highest yielding perennial legume available to Ohio farmers. There are, however, areas of heavy, poorly drained soils on which alfalfa does not grow well; stands survive only a year or two, and yields are low. On these soils birdsfoot trefoil outyields alfalfa and the birdsfoot stands remain productive for many years.

Birdsfoot trefoil should be seeded on such soils only when a long-lay meadow is desired. For one- or two-year meadows, red or alsike clover are as productive as birdsfoot trefoil and are easier to establish.

The first cutting of birdsfoot trefoil may be harvested about 10 days later than alfalfa, without a serious loss of leaves or decrease in palatability. Thus its use on a part of the meadow acreage lengthens the hay-making season. This is of particular importance on farms with large acreages of meadow crops.

Where an occasional hay harvest is intended, the Viking variety of upright growing birdsfoot trefoil is recommended.

## Areas of Adaption

As shown on the map, birdsfoot trefoil is better adapted in northern and central Ohio than in the southern section of the state.

Well adapted to birdsfoot trefoil. →

Although birdsfoot trefoil will grow in this area it is not as productive as in the northern section of the state. →


## The Plant

Birdsfoot trefoil looks somewhat like a weak-stemmed alfalfa. Although the upright types are less susceptible to lodging, the stems of all types are so fine that they tend to lodge unless supported by a vigorous grass. A well-established plant in a thin stand may have 100 or more stems from its single crown.

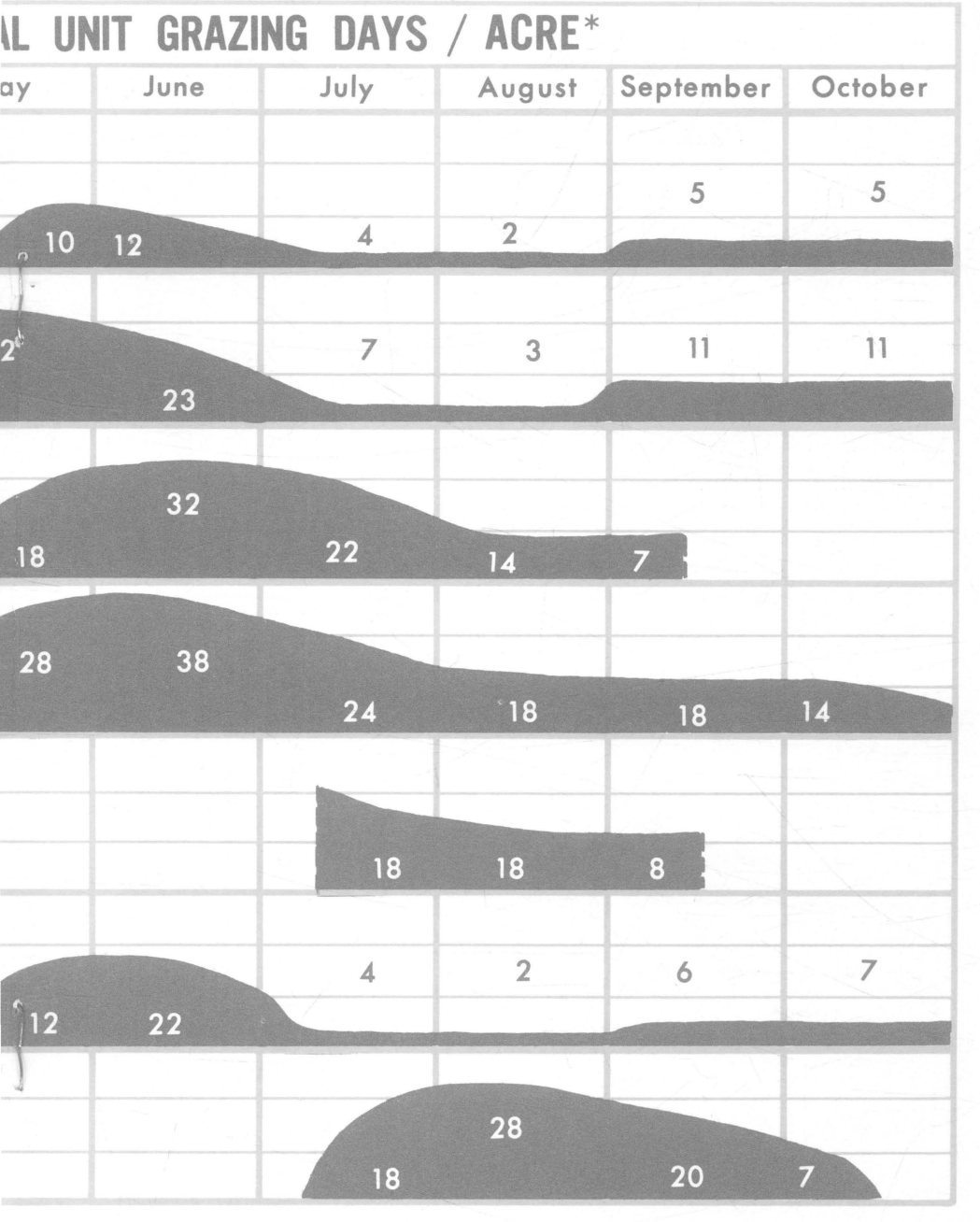
A single plant may have 100 or more stems.

# OHIO PASTURE

| CROP | ANIMAL UNITS PER ACRE | ANIMA |
|---|---|---|
| | | April Ma |
| **Permanent Pasture** (untreated) | 1<br>½ | |
| **Permanent Pasture** (Lime N (60#) P&K) | 1<br>½ | 12 32 |
| **Birdsfoot Trefoil** | 1<br>½ | |
| **Alfalfa Mixture** (To be plowed the following year) | 1<br>½ | 2 |
| **Alfalfa Mixture** (Following June hay) | 1<br>½ | |
| **Timothy** (To be plowed the following year) | 1<br>½ | |
| **Sudangrass** | 1<br>½ | |

* THESE ARE AVERAGE VALUES; W
PASTURE MANAGEMENT MUCH GRE

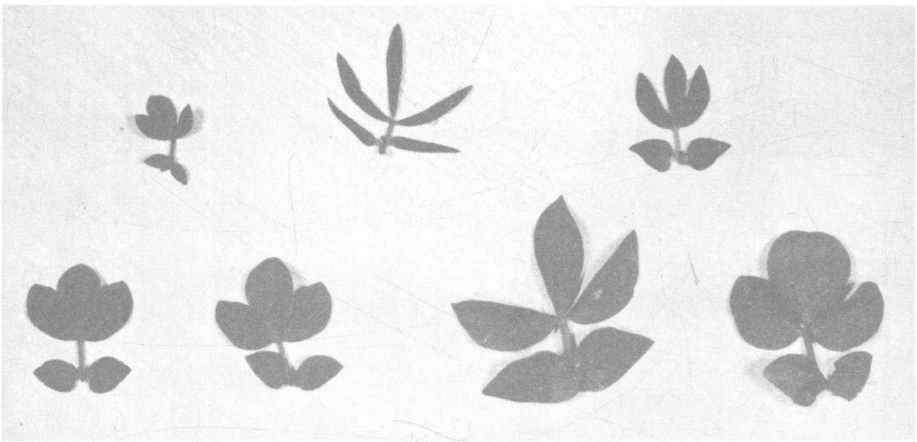
# E CALENDAR




WITH HIGH FERTILITY AND GOOD
REATER PRODUCTION MAY BE OBTAINED

The birdsfoot trefoil leaf consists of five leaflets — a terminal and two opposite leaflets at the tip of the leaf petiole and two opposite leaflets at its base. Birdsfoot trefoil is the only common legume with five leaflets.

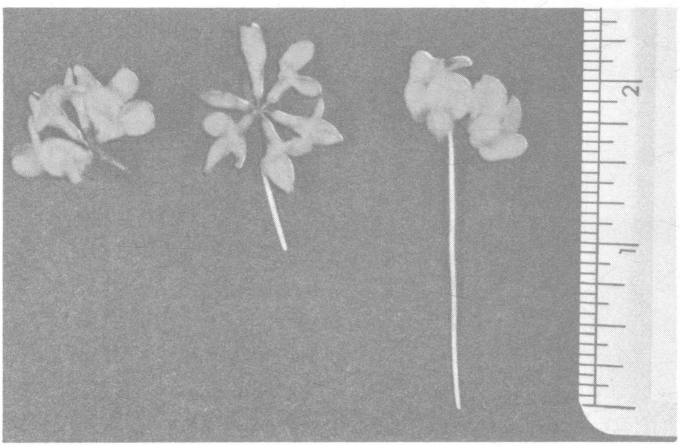
The shape of the leaflets varies greatly among the various strains, and between plants of the same strain. Considerable variation is found on the same plant at different stages of growth.



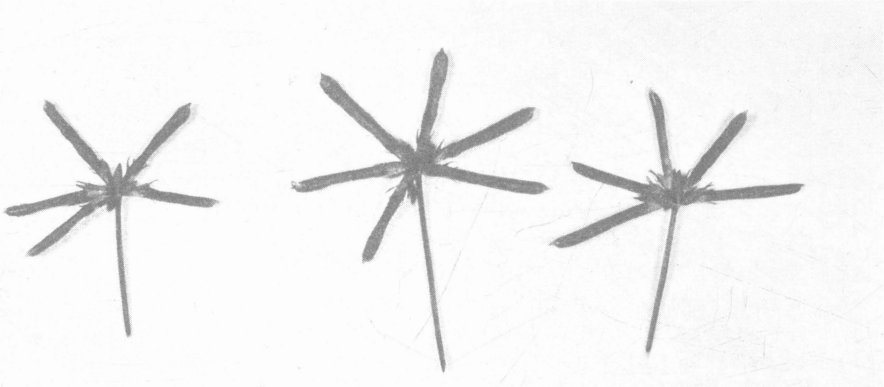
Birdsfoot trefoil leaves vary greatly in size and shape.

Flowers are borne in clusters at the ends of flowering stems. The largest amount of bloom occurs during June, although flowers continue to appear throughout the summer months. The flowers are bright yellow to orange in color and are shaped much like those of the common garden pea but are much smaller.

Seed is produced in a pod which is usually an inch or more in length. The seed is smaller than seeds of alfalfa. A single seed pod




Birdsfoot trefoil flowers.

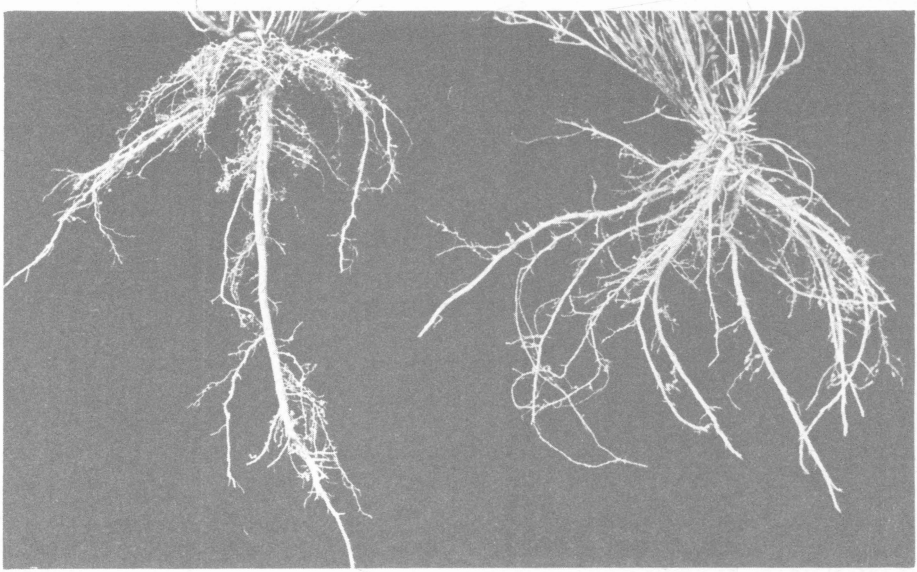


Seed pods.

will generally contain 10 or more seeds arranged in a straight line, as in a bean or pea pod.

Several seed pods are attached to the stem at a single point, and as they grow they are forced to spread apart giving the appearance of a bird's foot, thus the name. As the pods mature and become dry they split open, scattering the seed.

The root system of birdsfoot trefoil consists of a strong taproot with numerous branches which are attached nearly at right angles to the main taproot. The taproot does not go as deep as the taproot of alfalfa but is much deeper than red clover. The numerous branches are the principal reason for birdsfoot trefoil's resistance to heaving.



Root systems of birdsfoot trefoil.

# Seeding

## Soil Requirements

LIME — Birdsfoot trefoil can be established on soils with pH values as low as 5.5, but it makes much greater growth when the soil pH is in the range of 6.5 to 7.0. Seedings on low-lime soils are generally disappointing and unprofitable because of their low yield.

FERTILIZER — Birdsfoot trefoil has been described as a "poor land" legume. Because it will grow on soils low in fertility it has often been seeded on the least productive field on the farm. Birdsfoot trefoil is, however, highly responsive to soil fertility. Research at several experiment stations has shown the response of birdsfoot trefoil to phosphorus fertilization to be as great as or greater than that of alfalfa.

Much of the disappointment with birdsfoot can be traced to low fertility. On areas of medium or low productivity 400 to 600 pounds per acre of a complete fertilizer such as 4-16-16 or 4-16-8 should be applied at seeding time. On the more productive soils an 0-20-20 or 0-20-10 fertilizer should be used as the starter fertilizer.

Birdsfoot trefoil should be topdressed with 400 to 500 pounds per acre of an 0-20-20 or 0-20-10 analysis fertilizer every second year. Maximum growth is possible only when medium to high fertility levels are maintained.

DRAINAGE — Birdsfoot trefoil is adapted to a wide range of soil drainage conditions. It grows well in soils which are too poorly drained for alfalfa.

## Making the Seeding

SEEDBED PREPARATION — A firm, weed-free seedbed is essential for establishing a seeding. Failure to kill the existing vegetation will almost always result in a seeding failure. The method of seedbed preparation — disking or plowing — is not important as long as the old vegetation is *completely* killed.

SEEDING RATE AND MIXTURES —

*Birdsfoot trefoil 6 lb. and Timothy 4 lb. per acre.*

This is the best seed mixture for most farm situations. Birdsfoot trefoil-timothy is an excellent mixture for pasture or hay. Birdsfoot trefoil may not reach its maximum production until the second or third year after seeding. The inclusion of timothy in the mixture insures large yields during these early years. In time, the timothy will disappear, and bluegrass will come into the stand.

Other grasses may be substituted for timothy; however, orchardgrass, bromegrass, and tall fescue are more vigorous growing grasses and their use may result in poorer stands and growth of the birdsfoot trefoil. *No other legume should be included in the mixture.* Birdsfoot trefoil should not be included in a general mixture containing alfalfa or clovers.

*Birdsfoot trefoil 6 lb. and Kentucky Bluegrass 1-2 lb. per acre.*

This mixture should be used when a birdsfoot-bluegrass pasture is desired and the field contained little or no bluegrass prior to the start of seedbed preparation. In many fields, volunteer bluegrass will produce a stand of bluegrass almost as quickly as one can be secured by including bluegrass in the seed mixture.

*Birdsfoot trefoil 6 lb. per acre.*

Where an old bluegrass sod is being renovated and a birdsfoot-bluegrass pasture is desired, a seeding of birdsfoot trefoil alone will give satisfactory results.

TIME OF SEEDING — Birdsfoot trefoil should be seeded in the spring as early as the ground can be worked. Seeding with oats (4 to 6 pecks per acre) as a companion crop is recommended where weeds or erosion are likely to be a problem.

Seedings in winter grains — wheat, rye, or barley — are usually inferior to those made with oats. Summer seedings frequently do not become well enough established to survive the first winter and are not recommended.

INOCULATION — Birdsfoot trefoil requires a specific trefoil inoculant; when this inoculant is not used failure is certain.

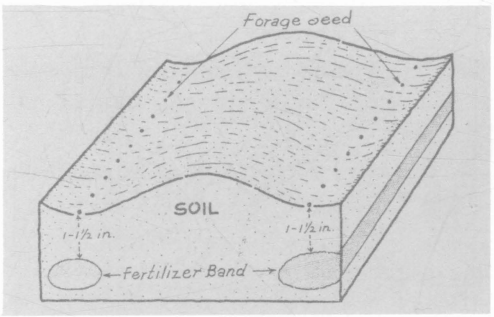
The preferred inoculation procedure is as follows:

1. Dampen the seed with sugar water. Use as much sugar as will dissolve in the water.
2. Add inoculant and mix thoroughly.
3. Mix corn starch, dried skim milk, or similar material with the seed until it will flow freely.
4. Seed at once. If the seeding is not completed in one day the seed should be reinoculated before it is sown.

BAND SEEDING — Even under ideal conditions birdsfoot trefoil seedlings are slow growing as compared to alfalfa or clovers. Band seeding is therefore particularly important.

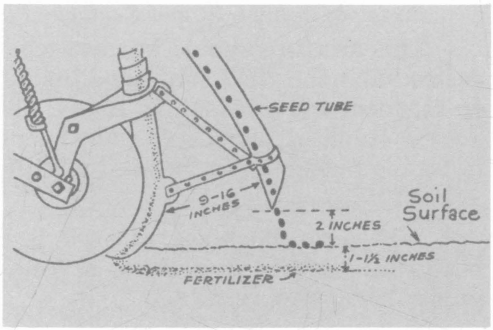
In band seeding the forage seed is placed directly above but not in contact with the band of fertilizer.

This placement of seed and fertilizer results in vigorous, fast-growing legume and grass seedlings.



Some new grain drills are equipped for band seeding; old drills can easily be altered to band seed.

The seed tube should be adjusted so that when the drill is operated the forage seed will be discharged at a point not more than 2 inches above the soil surface and 9 to 16 inches behind the disk.




The desirable distance between the disk and the point of discharge of the forage seed is dependent upon the condition of the seedbed, the rate of travel, and the depth of drilling. If forage seed is discharged too closely behind the disk it may be covered too deep.

*ne Do's and Don't's of Band Seeding*

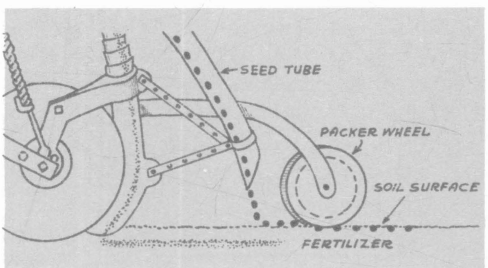
*Do* lower disks before attaching hose to bracket.

*Do* use a good grade of hose and fasten securely.

*Do* adjust hose and bracket. Check often during operation to see that seed is being placed directly over the fertilizer band and is not covered too deep.

*Do not* attach hoses to step board on drill.

*Do not* cultipack after seeding.




*Packer Wheels*

Packer wheels which follow directly behind the drill disks and firm the forage seed into the soil often result in more rapid germination and better stands of forage crops.

# Managing the Crop

## Care of the New Seeding

Birdsfoot trefoil cannot stand competition during the seeding year. The oats seeded with the trefoil should be grazed or cut for hay at or before they reach the milk stage. If the oats are to be grazed, the field should be heavily stocked so that the oats will be quickly eaten off. Livestock should be removed when the oats have been grazed to a height of 6 to 8 inches; the remaining growth should then be clipped and left on the field.

If weeds become a serious problem during mid-summer, the trefoil and weeds should be mowed. Light grazing is often possible during the late summer or early fall of the seeding year. *Do not over-graze.*

## Pasture Management

For maximum production birdsfoot trefoil pastures should be grazed rotationally with a 5 to 6 week period for recovery and regrowth following each grazing period. Birdsfoot pastures should not be grazed during the last two weeks of September and the month of October. During this six-week period birdsfoot trefoil, like alfalfa, stores food in its roots. Grazing during this critical period may result in loss of stands or in weakened plants which make less than normal spring growth.

One of the following grazing systems will fit most Ohio farm situations:

1) For full season grazing — start grazing during late April or early May and graze rotationally until mid-September. This system will result in the maximum total production from the pasture.

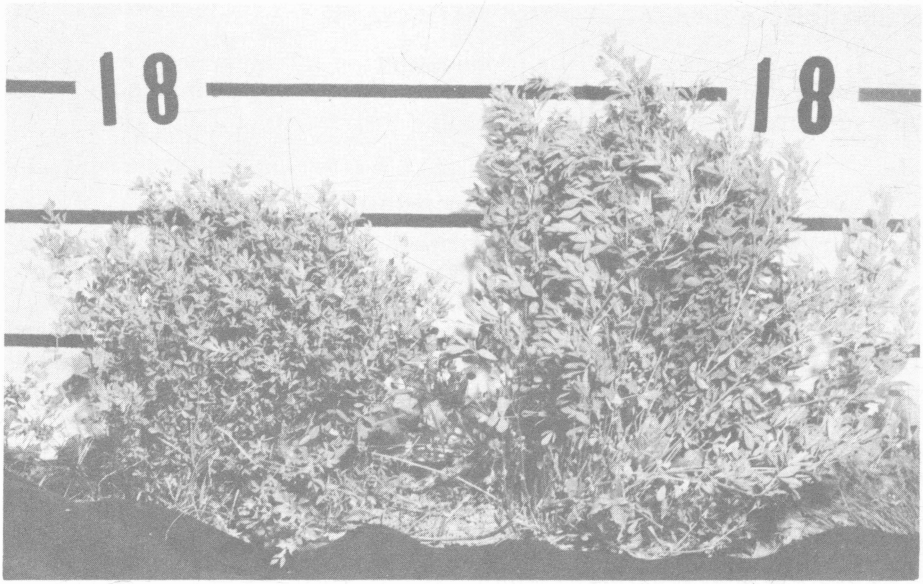
2) Deferred grazing — permit no grazing until mid-June; then graze rotationally until mid-September. Under this system bluegrass growing with the birdsfoot trefoil will be fully mature prior to grazing. Although mature bluegrass is not a high quality forage the combination of mature bluegrass with highly palatable birdsfoot trefoil makes an acceptable pasture. This system permits maximum grazing during the mid-summer months.

3) Hay and pasture — harvest the first growth as hay or silage and graze rotationally during July, August and the first two weeks of September.

There is no record of livestock bloat when grazing birdsfoot trefoil pastures.

Research at the Ohio Agricultural Experiment Station has shown that well-managed birdsfoot trefoil pastures furnish more grazing and produce more beef, lamb, and milk per acre than do bluegrass pastures

which receive liberal annual applications of nitrogen fertilizers. Birdsfoot trefoil pastures are somewhat less productive than are alfalfa-grass pastures. However, with proper management and fertilization, stands of birdsfoot trefoil should remain highly productive almost indefinitely; whereas alfalfa, even with the best grazing management, usually survives only three to five years.




Birdsfoot trefoil and alfalfa growing on a good alfalfa soil at Wooster.

## Harvesting as Hay

On soils well adapted to alfalfa, birdsfoot trefoil-grass meadows will yield approximately three-fourths as much as alfalfa. On soils not well-adapted to alfalfa, birdsfoot trefoil frequently outyields alfalfa as a hay crop.

The first cutting of birdsfoot trefoil meadow may be made approximately 10 days later than alfalfa. Seeding a portion of the long-lay meadow acreage to birdsfoot trefoil can lengthen the period during which high quality hay can be harvested from the first cutting. This spreading of the first hay harvest is of particular importance on farms with large acreages of meadow crop.

Birdsfoot trefoil meadows generally produce only 2 good hay cuttings each year as compared with the normal 3 cuttings from alfalfa.